IS 10776-2 (1984): Methods of measurement of electro-acoustical characteristics of hearing aids, Part 2: Additional measurements for hearing aids with induction pick-up coil input [LITD 7: Audio, Video and Multimedia Systems and Equipment]

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IEC Pub 118-1 (1983)

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Indian Standard

(Reaffirmed 2001)

METHODS OF MEASUREMENT OF THE ELECTROACOUSTICAL CHARACTERISTICS OF HEARING AIDS

PART 2 ADDITIONAL MEASUREMENTS FOR HEARING AIDS WITH INDUCTION PICK-UP COIL INPUT

(IEC Title : Hearing Aids, Part 1 : Hearing Aids with Induction Pick-up Coil Input)

National Foreword

This Indian Standard, which is identical with IEC Pub 118-1 (1983) 'Hearing aids, Part 1 : Hearing aids with induction pick-up coil input', issued by the International Electrotechnical Commission (IEC), was adopted by the Indian Standards Institution on the recommendation of Acoustics Sectional Committee and approved by Electronics and Telecommunication Division Council.

Cross Reference

In this Indian Standard, the following International Standards are referred to. Read in their respective places the following :

International Standard	*Indian Standard*
IEC Pub 118-0 Hearing Aids, Part 0 : Measurement of Electroacoustical characteristics	IS : 10776 (Part 1)-1984 Methods of measurement of electro-acoustical characteristics of hearing aids : Part 1 General measurements for air-conduction hearing aids (Technically equivalent)
IEC Pub 711 Occluded-ear simulator for the measurement of earphones coupled to the Ear by Ear Inserts	IS : 10780-1984 Occluded-ear simulator for the measurement of earphones coupled to the ear by ear inserts (Technically equivalent)

The technical committee responsible for the preparation of this standard has reviewed the provision of IEC Pub 118-1 (1983) and has decided that they are acceptable for use in conjunction with this standard.

(Reaffirmed 1995)

Acoustics Sectional Committee, LTDC 5 [Ref : Doc : LTDC 5 (884)]

Adopted 21 September 1984

Gr 3

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1. Object

1.1 The purpose of this standard is to describe a method of determining the physical performance of hearing aids using an induction pick-up coil within an audio-frequency magnetic field. The methods specified in this publication give information on the measurement in Sub-clauses 4.4 and 4.5.

2. Explanation of terms

Terms other than those below are specified in IEC Publication 118-0: Hearing Aids, Part 0: Measurement of Electroacoustical Characteristics, and IEC Publication 711: Occluded-ear Simulator for the Measurement of Earphones Coupled to the Ear by Ear Inserts

2.1 *Test point*

A position in the test enclosure at which the strength of the magnetic field is defined.

2.2 *Test space*

A space the centre of which is the test point and within which the magnetic field strength is between stated limits for magnitude and direction, and where the hearing aid is to be placed for test.

2.3 *Frequency response*

The sound pressure level measured in the coupler expressed as a function of frequency under specified test conditions.

2.4 *Sensitivity*

The sound pressure level in the coupler under essentially linear input-output conditions at a specified magnetic input field strength and at a specified frequency.

2.5 *Maximum sensitivity*

The maximum obtainable sound pressure level in the coupler under essentially linear input-output conditions at a specified magnetic input field strength and at a specified frequency, allowing all possible settings of the hearing aid controls and with the hearing aid oriented relative to the test field in such a way that the magnetic induction in the induction pick-up coil has its maximum value.

3. Test equipment

3.1 *General*

Throughout this standard, all sound pressure levels are referred to 20 μPa and measured according to IEC Publications 118-0 and 711. Magnetic field strength is expressed in A/m or mA/m.

3.2 *Test space*

When the input signal to the hearing aid under test is turned off, the residual output level, due to ambient hum, noise and stray fields in the test space, shall drop at least 10 dB and preferably 20 dB or more from the output level with the signal on.

3.3 *Magnetic field source*

3.3.1 The magnetic field source shall not contain any ferromagnetic material.

3.3.2 The magnetic field source shall be provided with a calibration expressing the relationship between the magnetic field strength in A/m at the test point and the input current in amperes.

3.3.3 The magnetic field source shall be of such shape and dimensions that inside a sphere of diameter 10 cm of which the centre is the test point, the deviation from nominal values in magnitude and direction is less than ± 5% and ± 10°, respectively.

Note. – A square loop with a side length a greater than 0.5 m or a circular loop with a diameter d greater than 0.56 m will meet these specifications.

3.3.4 The total harmonic distortion of the magnetic field shall not exceed 1%.

Note. – This condition will be met if the distortion of the input current is less than 1%.

3.3.5 The magnetic field strength at the test point shall be maintained within an overall accuracy of ± 1.5 dB.

4 Test procedure

4.1 *Strength of magnetic field source*

The magnetic field strength produced by the magnetic field source is computed from the geometry of the source.

Notes 1. – For example, the magnetic field strength in the centre of a square loop with a side of a metres and carrying a current of i amperes is given by:

$$H = \frac{2\sqrt{2}}{\pi} \cdot \frac{i}{a} \text{ A/m}$$

In the centre of a circular loop with a diameter of d metres carrying a current of i amperes, the magnetic field strength is given by:

$$H = \frac{i}{d} \text{ A/m}$$

2. – One way to secure essentially constant current conditions is to drive the magnetic field source from a source having a constant e.m.f. and an internal impedance at least 100 times greater than the magnetic field source input impedance in the frequency range 100 Hz to 10000 Hz, which, in the case of a low-impedance generator, may be accomplished by a resistor connected in series with the output terminals of the generator.

3. – The test space shall be remote from any field-disturbing iron or other ferromagnetic material or other material in which eddy currents can be induced, that could give rise to a field-disturbance.

4.2 *Locating the hearing aid for test*

4.2.1 The support for the hearing aid shall be non-metallic.

4.2.2 The hearing aid shall be placed in the centre of the test space and oriented in a way that maximum signal pick-up is obtained. The orientation should be stated.

4.3 *Normal operating conditions for the hearing aid*

The normal hearing aid operating conditions applicable to measurements are prescribed in IEC Publication 118-0 and IEC Publication 711. As the material and the construction of the power source might influence the results, the actual type of source should be stated.

4.4 *Frequency response*

As the tone control settings or gain control characteristic are likely to have the same effect upon the frequency response whether the hearing aid is connected to the microphone input or to the induction pick-up coil input, it is necessary to measure the frequency response only under normal operating conditions.

The test procedure is:

a) Adjust the magnetic field at the test point to 10 mA/m ±5% at 1600 Hz or 2500 Hz when appropriate.

b) Adjust the gain control to the reference test gain control position (see IEC Publication 118-0). Set other controls into desired positions. If the hearing aid does not have sufficient gain to permit this, set the gain control at maximum.

c) Vary the frequency of the source over the frequency range 100 Hz to 10000 Hz, keeping the magnetic field constant at 10 mA/m.

Note. – In certain cases – for example, if a significant degree of non-linearity should occur – it may be necessary to employ a lower input magnetic field strength or a lower position of the gain control to define the frequency response.

When non-linearity does not occur, a higher input magnetic field strength may be employed to obtain a better signal-to-noise ratio.
When either is done, the test conditions shall be stated.

d) For continuous recording, the sweep rate shall be such that the response does not differ by more than 1.0 dB from the steady-state value at any frequency.

e) The frequency response is plotted as the coupler sound pressure level versus frequency at a constant magnetic input field strength. The magnetic input field strength shall be stated.

4.5 *Sensitivity*

4.5.1 The sensitivity is expressed as the output sound pressure level at a magnetic field strength of 1 mA/m.

Note. – Expressing the sensitivity at a magnetic field strength of 1 mA/m does not necessarily mean that the sensitivity is measured at a magnetic field strength of 1 mA/m.

4.5.2 *Maximum sensitivity*

The test procedure is:

Turn the gain control full on; set other controls, if any, in such a position that maximum gain is obtained and measure the coupler sound pressure level at an input signal sufficiently low to provide essentially linear input-output conditions. When possible, a value of 1 mA/m or 10 mA/m is recommended.

Note. – In cases where the gain control position has no influence on the frequency response, it is necessary only to measure the maximum sensitivity at only one frequency, e.g. 1600 Hz or 2500 Hz when appropriate. From the result of this measurement, in conjunction with the frequency response the maximum sensitivity at all frequencies within the frequency range 100 Hz to 10000 Hz can be derived.